Services to the Laboratory

The Los Alamos Seismic Hazards Program

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Los Alamos lies at the local, active western boundary of the Rio Grande rift, a major tectonic feature of the North American continent, and the local rift boundary includes three fault zones. A program to study seismic hazards that may arise from these fault zones was established in the mid-1980s. The program includes paleoseismic and structural geology studies, a felt-earthquake response team; and community outreach. Paleoseismic investigations have proceeded intermittently over the last 10 years. Constraints for Holocene (within the last 10,000 years) ruptures on each of the local, major faults were determined, and data indicate that numerous prehistoric earthquakes, of approximate magnitude 7, occurred on each fault. We are continuing to study recurrence intervals and possible fault interdependence for these large earthquakes. Since 1991, at least 250 Los Alamos area residents have felt three tiny earthquakes, the largest being magnitude 2. In collaboration with the program seismologist, we determined that unusually shallow focal depths and site-specific ground effects have contributed to the surprisingly high ground motion intensities that resulted from these small earthquakes.

More recently, we have evaluated faults at existing and future nuclear facilities at LANL. Understanding the seismic risk at Los Alamos is a fundamental component of management and development for the nuclear facilities and central to the Laboratory's mission. We developed a technique called "high-precision geologic mapping," which we have applied to about one-quarter of the Laboratory area. This technique reveals—in unprecedented detail—the structural interactions between potentially active faults and the nature of ruptures at fault tips.

We have also contributed extensively to the Laboratory's recovery efforts from the Cerro Grande Fire by studying the impact of topography on the potential for flooding and contaminant transport.

Another important part of this program is community outreach. We routinely present talks to school children and civic groups on earthquake hazards in northern New Mexico. A member of our staff is a national instructor for the Federal Emergency Management Agency earthquake curricula, and we provide a member for the New Mexico Seismic Safety Council (New Mexico Department of Public Safety).

Northern New Mexico Math and Science Academy

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With the dual objectives of producing students who are soundly prepared in core academic subjects like mathematics and science and increasing the pool of qualified teachers, EES Division, along with the Laboratory's Science and Technology Base Program office, recently funded the Northern New Mexico Math and Science Academy. The academy focuses on helping middle school students, teachers, and student-teachers improve their skills in these all-important academic areas. During the summer, the teachers, who come from Chama, Española, and Mora middle schools, spend two weeks building math and science curricula under the guidance of two master teachers. During the school year, master teachers travel to the schools in the program at least once a week to help the teachers and student-teachers with on-going curriculum revision, unit planning, and teaching strategies. This project is expected to last about five years, with Los Alamos involvement through the development, implementation, and transition stages. At the end of the five-year period, we expect the partnering districts to assume full responsibility for this program. We expect to add additional school districts to the program in the near future.

Los Alamos Seismic Network Research

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The Los Alamos Seismic Network, which has been in operation for more than 25 years, collects data on earthquake activity in north-central New Mexico and provides scientific and environmental surveillance information to LANL. Since its inception, the network has recorded more than 2,500 earthquakes, which have occurred in most areas of north-central New Mexico. Almost all of these were so small (magnitudes of 2 or smaller) they would not have been identifiable without instrument recordings; these are called "microearthquakes." Several, however, were large enough to be felt in Los Alamos and surrounding areas. The network also provides data to the Bradbury Science Museum for educational and outreach activities.

Water Vapor Monitoring at the Los Alamos Low-Level-Waste Storage Facility

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At area G, the Los Alamos low-level-waste storage facility, we are using the Raman lidar to study a major problem, evapotranspiration, the spatial variability of water vapor and water flux over the facility. The typical lidar is used to observe atmospheric phenomenon in the middle and upper stratosphere, while sacrificing the near-field, also known as the boundary layer. The Los Alamos Raman lidar is a scanning instrument, designed specifically to observe the atmosphere in the first few kilometers above the Earth's surface.

By understanding the variability in the water vapor and flux, we will gain a better understanding of the water-energy balance at this complex site. A major problem at area G is that the volume of both infiltration and evapotranspiration are unknown. Our spatially resolved lidar flux maps should reduce the uncertainties in the evapotranspiration volume and allow us to better estimate how much water is infiltrating the site. We will use a HIGRAD simulation to extend the lidar observations to year-round estimates. To date, a micro-meteorolgical station has been set up at the site, lidar images have been processed, and some simulation/verification runs have been performed. The software for flux mapping has been developed and tested at a site in southern Arizona. We have gathered lidar data from over area G, and we have generated preliminary models. A micrometeorological flux station has been set up at area G as well.

Ecological Risk Assessment of the Pajarito Plateau

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We performed ecological risk assessments on various animal species on the Pajarito Plateau. Using ECORSK.5, we incorporated a modified EPA hazard-quotient to locate LANL radioactive and non-radioactive wastes and to integrate them with species habitats and home ranges. Our results will be used to determine whether the resulting indices are significant for causing ecological damage and to identify the contaminated areas that contribute significantly to the hazard indices. The second code is BIOTRAN.2, a pharmacokinetics code that simulates the transport of contaminants through ecosystems. This code will be used to verify outputs from ECORSK.5. We found a small impact for the deer mouse; however, natural and regional background sources of contamination contributed the dominant portion of total risk, indicating that the safe limits we originally established may have been overly conservative.